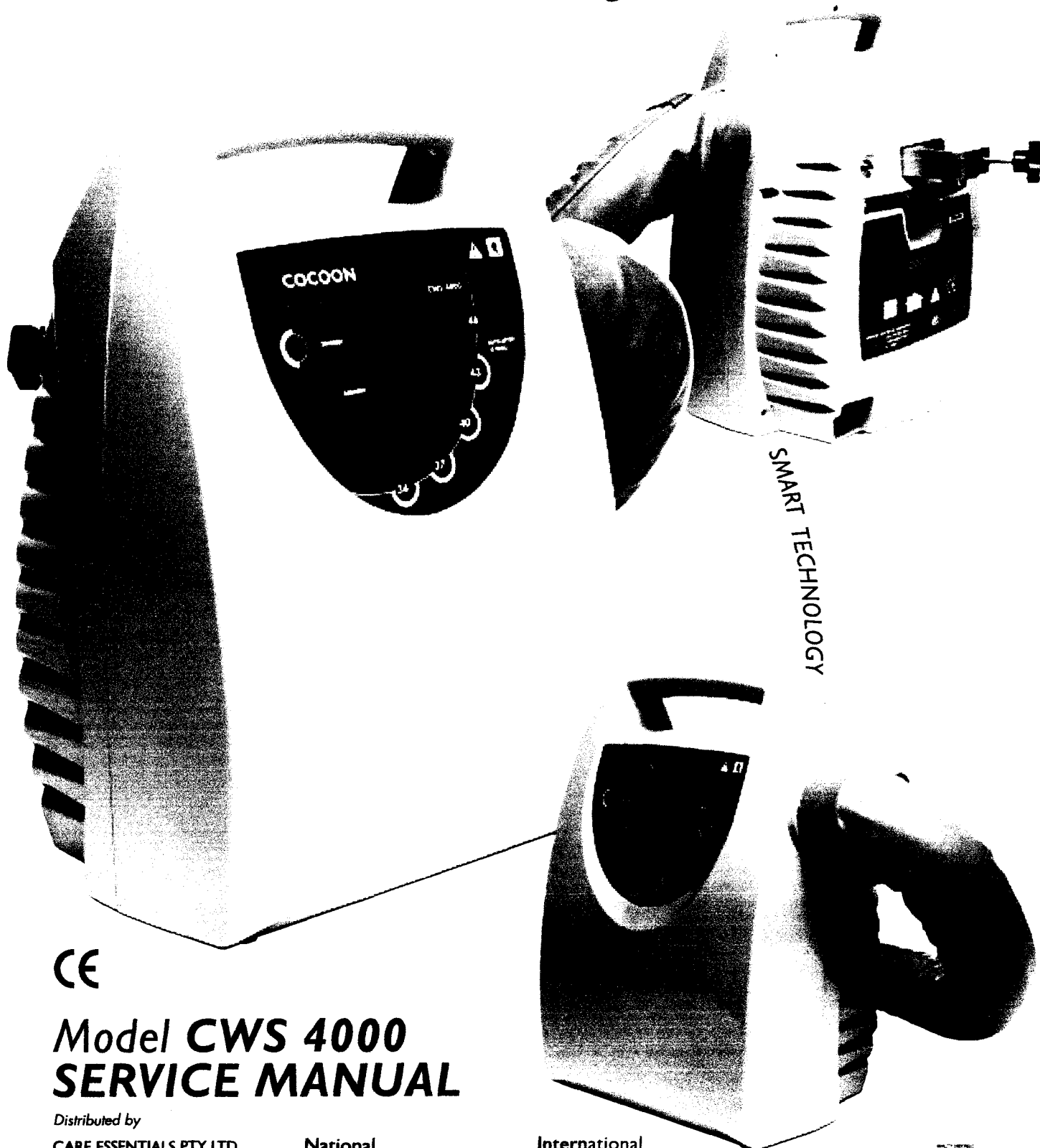




Essential care before, during and after surgery.

Convective Warming Machine



CE

Model CWS 4000 SERVICE MANUAL

Distributed by

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1. INTRODUCTION

It is a pre-requisite for all persons skilled in servicing medical devices to understand the information contained in this Manual. Read and understand this Manual and the Operator Manual and all precautions prior to servicing the Cocoon Convective Warming System.

When used with Care Essentials patient warming blankets, the Care Essentials CWS4000 provides a continuous method of warming patients and is intended for preventing and treating hypothermia. The Cocoon Convective Warming System consists of a CWS4000 and a warming blanket. A connecting hose conducts heated air from the CWS4000 to the warming blanket.

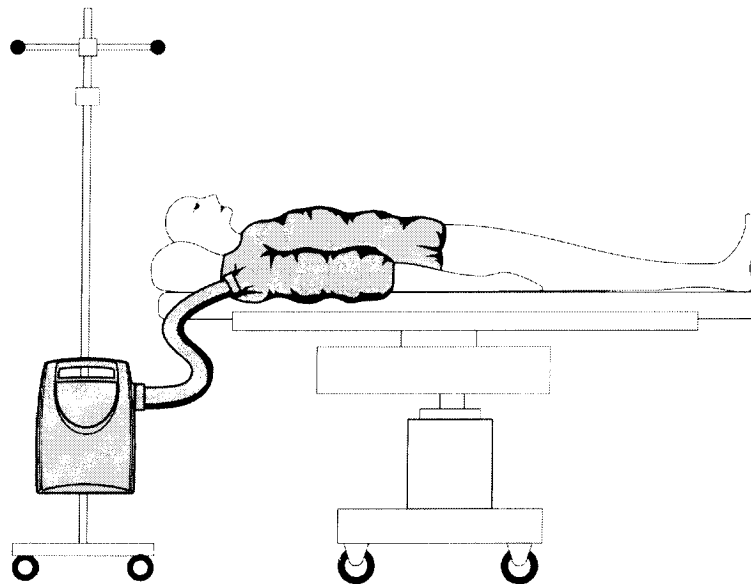


Figure 1 Convective Warming System

Care Essentials recommend that a program of regular routine maintenance, electrical safety and performance inspections be instituted for the CWS4000 as described in Section 4 below.

The CWS4000 is a mains-powered, microprocessor-controlled device that delivers a continuous flow of temperature-controlled air through a flexible hose to the warming blanket. The temperature of the air delivered to the blanket can be set to one of six settings: ambient, 34°C, 37°C, 40°C, 43°C, or 46°C. When a temperature of 46°C is selected, the setting automatically drops to 43°C after 10 minutes. The CWS4000 will not cool the air delivered to the blanket below the ambient temperature of the room.

Air is drawn into the rear of the CWS4000 and passes through a bacteriological HEPA filter. The CWS4000 includes a number of under- and over-temperature prevention systems and in a temperature fault condition it automatically shuts down and signals an alarm.

This Manual presents all the relevant service information for the Care Essentials CWS4000 Cocoon Warming System. This information is provided as a service to engineering and technical personnel. This information is intended for the fair purposes of operation and maintenance of the CWS4000. It is provided as Commercial-In-Confidence material to the Care Essentials Distributor or CWS4000 owner and shall not be made available to any other organization or person without the specific written permission of Care Essentials.

While every attempt has been made to ensure this Manual is accurate and complete, no responsibility is taken for any errors or omissions. Care Essentials has a policy of continuous product improvement and product specifications and component types are subject to change without notice.

If you, as a user of this manual, have any relevant comments or questions about the CWS4000 or this Manual, your communication with Care Essentials would be welcomed. Our contact details are located on the first page of this Manual.

2. OPERATION

2.1. Unit Setup

The CWS4000 may be placed on the floor, mounted on the foot of the bed using the foldout brackets, or clamped to an IV pole using the IV pole clamp. When using an IV pole, do not mount the CWS4000 higher than 1 metre or it could tip over. Do not place the CWS4000 on a bed surface. Note that if the CWS4000 is placed on the floor, increased levels of dust and lint could reduce filter life.

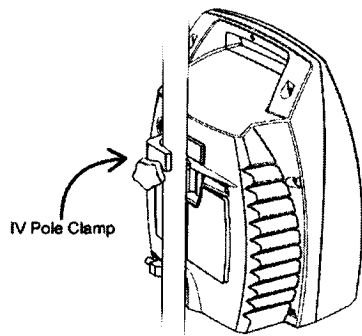


Figure 2 IV pole or stand mounted

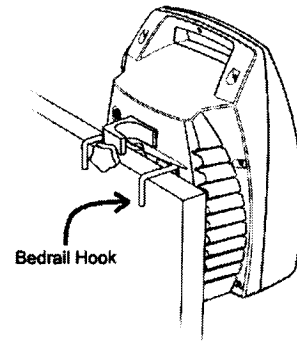


Figure 3 Bed rail mounted

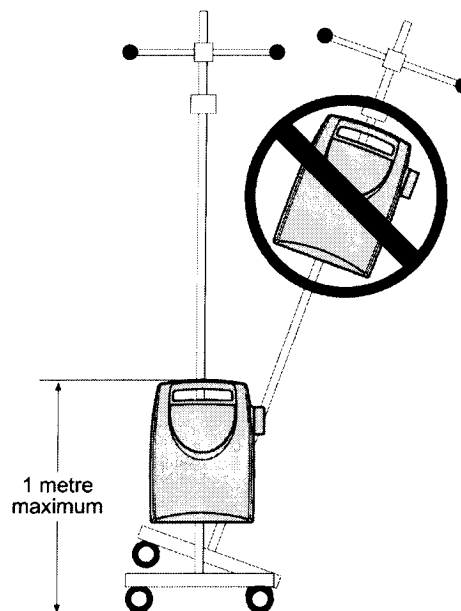


Figure 4 Pole mounting height limit

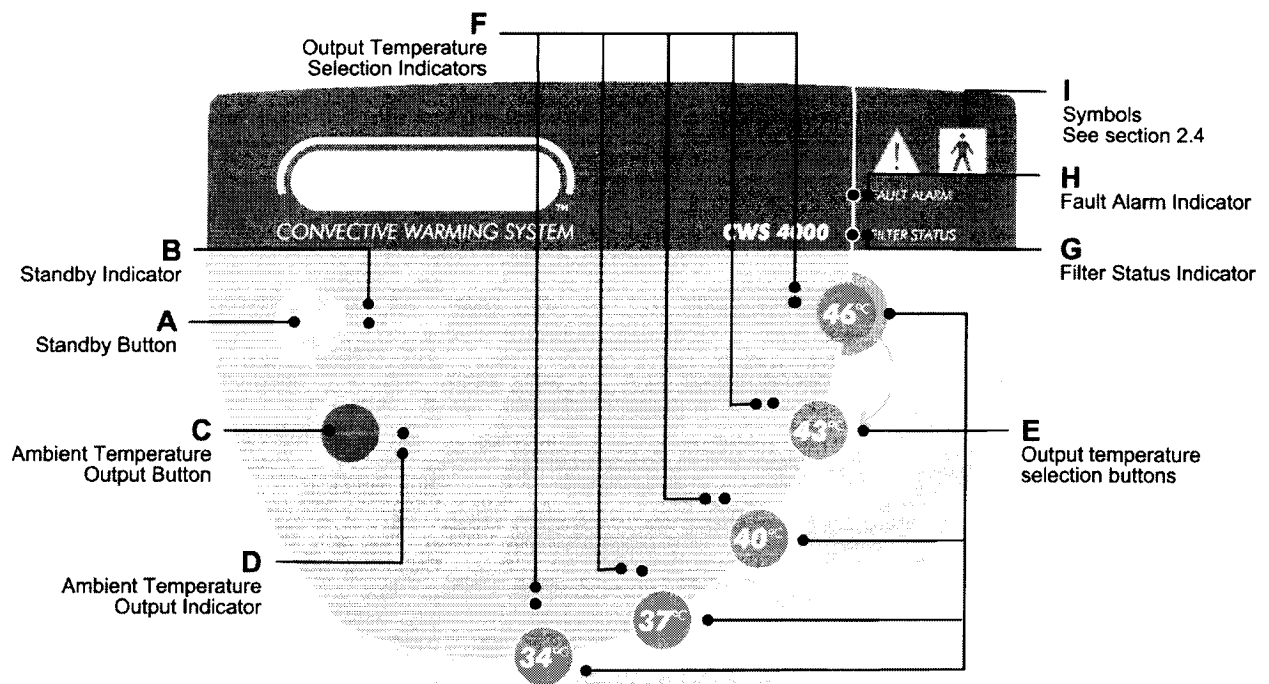


Figure 5 Operator control panel

2.2. Getting Started

Plug the mains cable into a conventional, properly earthed 240 Volt 10 Amp mains power socket-outlet and switch it on. The green **Standby indicator (B)** will illuminate and the CWS4000 will beep when power is connected.

Ensure that air is not prevented from entering the inlet slots at the sides by blankets or other objects.

Remove the warming blanket from its packaging. Unfold the warming blanket and place it over the patient. Connect the air delivery hose to the warming blanket by pushing the plastic fitting into the air inlet port.

2.3. Unit Operation Procedure

Select the desired temperature on the control panel pressing either one of the **Output temperature selection buttons (E)** or **Ambient Temperature Output Button (C)**. The appropriate green or yellow light (**D** or **F**) will indicate the selected temperature setting. Another temperature may be selected at any time. The air temperature surrounding the patient will vary at each setting, depending upon ambient air temperature and the quality of the insulating blanket or sheet that is used over the warming blanket. When using the 34°C, 37°C, 40°C, 43°C, or 46°C temperature settings, place your hand under the warming blanket to confirm that the CWS4000 is supplying warm air. Place a sheet or blanket over the inflated warming blanket to maximize the efficiency and minimize the heat loss from the system.

The internal timer will automatically decrease the temperature setting from 46°C to 43°C after 10 minutes. This timer can be reset by momentarily selecting another setting and then re-selecting 46°C.

Switch the unit off by pressing the **Standby Button (A)**. The green **Standby indicator (B)** will illuminate when the unit is off.

The unit will automatically switch off in an alarm condition and the green **Standby indicator (B)** will illuminate together with the red **Fault Alarm indicator (H)**. In the event the **Fault Alarm**

indicator (H) illuminates, disconnect the CWS4000 from the patient and from the mains power supply and have it serviced by trained personnel.

The **Filter Status indicator (G)** provides the user with information on remaining filter life. This indicator is interpreted as follows:

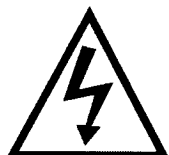
Indication	Description
Steady green indicator	Filter status normal
Steady orange indicator	Filter life has reached 950 hours
Flashing orange indicator	Filter life has reached 990 hours
Steady red indicator	Filter life has exceeded 1000 hours and requires replacing

2.4. Symbols

The following symbols are used on the CWS4000:



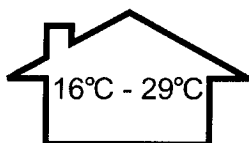
Attention: consult accompanying documents



Dangerous voltage



Type BF applied part



Ambient operating temperature range, indoor use only

3. SAFETY PRECAUTIONS

Review the following safety precautions prior to servicing the CWS4000.

3.1. Danger

- Explosive hazard. Do not use in the presence of flammable anaesthetic agents.
- Risk of electric shock. Disconnect mains power before servicing the CWS4000.

3.2. Warning

- Ensure that no direct or indirect contact is made between the patient and the communications connector located on the rear of the CWS4000.
- The CWS4000 must only be opened or serviced by qualified personnel such as certified biomedical electronics technicians or certified clinical engineers familiar with repair practices for servicing medical devices, and in accordance with the Service Manual. Damage to the CWS4000 or malfunction could otherwise result.
- Ensure the CWS4000 is subjected to the specified routine electrical safety and performance inspections.
- In the event of excess fluid contact with the CWS4000 it is recommended that the unit be disconnected from the mains power supply and checked by qualified personnel.
- Use only in accordance with Operator Manual instructions.

3.3. Caution

- Operate the CWS4000 only in the specified supply voltage range and environmental conditions and as detailed in Section 11 below.
- When using an IV pole, do not mount the CWS4000 higher than 1 metre or it could tip over.
- The 46°C setting is not recommended for patients who are non-responsive or with impaired circulation.
- It is not recommended that the unit be operated after the filter has exceeded the specified life period.

3.4. Electromagnetic Interference

The CWS4000 has been designed to comply with IEC 601-1-2:2004 (Medical electrical equipment – Part 1: General requirements for safety. 2. Collateral standard: electromagnetic compatibility – Requirements and tests) but this does not guarantee that other equipment in the vicinity will not be affected by the electromagnetic emissions from the CWS4000. Similarly, other equipment in the vicinity may affect the operation of the CWS4000.

It is recommended that all equipment used near the CWS4000 comply with the relevant electromagnetic compatibility requirements for that equipment and to check before use that no interference is evident or disruptive. Increasing the distance between offending devices, and keeping interconnecting leads as short as possible will help reduce the effect.

4. PREVENTATIVE MAINTENANCE

4.1. Cleaning

- Clean the CWS4000 control panel, enclosure exterior, and hose with a soft cloth lightly dampened with a non-staining hospital disinfectant.
- Clean accumulated dirt and lint from the air inlet slots using a vacuum cleaner.

4.2. Electrical Safety Inspection

Care Essentials recommend that the CWS4000 receive regular electrical safety inspections. Information on the type and frequency of inspections may be obtained from locally published technical standards.

In Australia, the relevant technical standards are:

- **AS3551** Technical management programs for medical devices.
This standard specifies procedures required to develop equipment management programs for medical devices. Some of these include procedures for acceptance, fault management and routine testing of medical devices. This standard specifies electrical safety, essential safety and performance testing.
- **AS2500** Guide to the safe use of electricity in patient care.
This standard provides a comprehensive guide to the safe use of electrically operated equipment used in health care facilities. Measures are detailed to provide and maintain patient and operator safety, including details of the classes of equipment and electrical installations to be used for particular medical procedures.

Programmed electrical safety inspections are essential to confirm continued operator and patient safety. Mandatory, statutory requirements for electrical safety inspections may also apply.

4.3. Performance Inspection

Care Essentials recommend that the CWS4000 receive at least an annual performance inspection to verify CWS4000 functions. The CWS4000 does not require adjustment or calibration.

Items Required:

- CWS4000 Operator & Service Manuals.
- Digital Thermometer.

STEP	PROCEDURE
1	If you have not already done so, read the CWS4000 Operator and Service Manuals.
2	• Place the CWS4000 on a firm, level surface. • Do not connect the delivery hose to a warming blanket. • Connect the CWS4000 to mains power.
3	Familiarise yourself with the operation of the CWS4000 by operating the CWS4000 with reference to the CWS4000 Operator and Service Manuals.
4	The temperature control system is verified as follows: • Ensure the delivery hose cover is undamaged and that it covers the entire hose. • Ensure that the environmental conditions are 20°C to 22°C, 30% to 70% relative humidity, non-condensing. • Place the digital thermometer sensor in the centre of the delivery hose outlet as shown in Figure 6. • Check that the temperature of delivered air stabilises within five (5) minutes following a change in set temperature. • Check that the temperature of delivered air corresponds with the set temperature to within $\pm 2^{\circ}\text{C}$. • Note that some variation between the set temperature and temperature of delivered air is possible because of heat loss that occurs in the delivery hose. The magnitude of the heat loss will depend on the ambient temperature and the degree to which the hose is longitudinally compressed or extended.

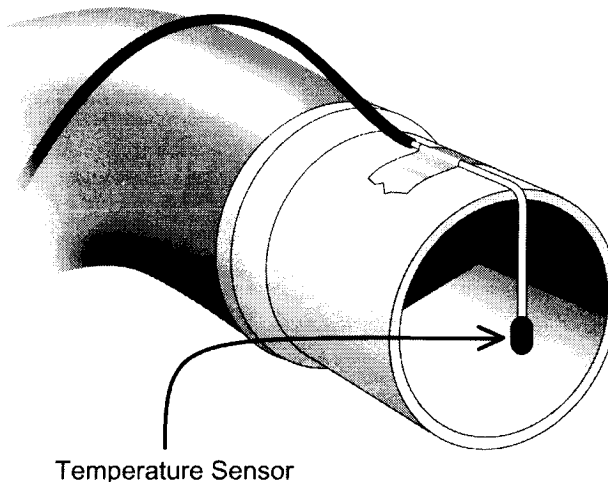


Figure 6 Delivery hose outlet showing temperature sensor position

4.4. Temperature Limit Thermostat Test Procedure

The CWS4000 temperature limit thermostat test is completely optional and may be performed at the discretion of those responsible for the technical management of the CWS4000. The CWS4000 temperature limit thermostat function *does not require* adjustment, calibration or performance inspection.

The maximum delivered air temperature is not only limited by the control system but by two series-connected bimetallic auto-resetting thermostats. These thermostats are located in the exhaust air stream and will interrupt power to the CWS4000 should the output air temperature exceed a predetermined limit. Either of these two independently operating thermostats will remove power from the CWS4000 if the delivered air exceeds a preset high limit temperature, automatically restoring power when the thermostat temperature fails to a safe level.

This test procedure may be briefly described as follows. The CWS4000 is set up with the various items required to perform the test. The CWS4000 is energised and operated at a set temperature of 46°C until it has "warmed up." The test is commenced through a special process that switches the heater on continuously, simulating a possible fault condition. The test time and delivery hose air temperature are monitored. The test is passed if the CWS4000 is de-energised less than 8 minutes after the test start. The delivery hose air temperature at the conclusion of the test may be as high as 60°C. Note that this test will only produce a valid result if it is performed at an ambient temperature of 21°C, or greater.

Items Required:

- CWS4000 Operator and Service Manuals.
- Personal Computer (PC) with a free serial communications (Com) port and a suitable Terminal program, eg HyperTerminal™, which is provided with Microsoft Windows™.
- Digital Thermometer.
- CWS4000 RS232-Logic Communications Cable

The Cocoon Warming Machine model CSW4000 can have three different versions for the test cable.

This cable is for the over temperature performance testing.

Details of the three versions are:

A. Machines with Serial Numbers commencing 4-0001	Yellow Dot
B. Machines with Serial Numbers commencing 4-0100	Red Dot
C. Machines with Serial Numbers commencing 4-0200	Green Dot

In the event you need to access any of these cables please contact your location Distributor or Care Essentials Pty Ltd.

STEP	PROCEDURE
1	If you have not already done so, read the CWS4000 Instruction Manual and Service Manual. Read all of this procedure.
2	- Place the CWS4000 on a firm, level surface. - Do not connect the PVC delivery hose to a warming blanket. - Disconnect the CWS4000 from mains power.
3	- Locate the enclosure rear with the warning label. - Locate the small black cable socket on the top left of the enclosure rear. - Insert the cable plug into the socket. It should snap into place. - Insert the cable D-connector into a free Com port connector on the PC.
4	Place the digital thermometer sensor in the centre of the delivery hose outlet as shown in Figure 6 above.
5	- Connect the CWS4000 to mains power. - Select the 46°C temperature setting. - Operate the CWS4000 on the 46°C temperature setting for at least 10 minutes prior to commencing the thermostat test.
6	While the CWS4000 is "warming up", start the Terminal program on the PC and select the settings as follows: - Select the Com port connected to the Converter cable in Step 4 above. - Baud rate – 9600, data bits – 8, parity – none, flow control – none. - Terminal emulation – VT100, character set – ASCII. - Append line feeds to incoming line ends – enabled.
7	Follow the instructions shown on the Terminal window: - When a correct connection is established between the CWS4000 and the PC, a dot (.) is received every second. - Press the spacebar to display the root screen. - Press "T" to display the over-temperature thermostat test screen. - The 46°C temperature setting must be selected in order for the test to proceed. - To initiate the over-temperature thermostat test, SLOWLY type, "YES" then press the Enter key. To stop the test, press any key or change the CWS4000 temperature setting. - The CWS4000 is deemed to have passed the test if a thermostat trips in under eight (8) minutes. - Confirm that the thermostat resets after several minutes, restoring power to the CWS4000.
8	- Disconnect the CWS4000 from mains power. - Disconnect the cable from the CWS4000 and PC.
9	Confirm that the CWS4000 functions correctly by undertaking a performance inspection as detailed in Section 4.3 above.

4.5. Filter Replacement

The CWS4000 has a replaceable HEPA filter. Under normal use, replace the HEPA filter inside the CWS4000 every 1000 operating hours or 12 months, whichever occurs first. The FILTER STATUS indicator will warn of the need for filter replacement.

Items Required:

- CWS4000 Operator & Service Manuals.
- Philips Number 1 and 2 Screwdrivers.
- 13 mm spanner.
- HEPA filter.

STEP	PROCEDURE
1	If you have not already done so, read the CWS4000 Operator and Service Manuals.
2	• Place the CWS4000 on a firm, level surface. • Do not connect the PVC delivery hose to a warming blanket. • Disconnect the CWS4000 from mains power.
3	• Locate the enclosure rear with the warning label. • Remove the seven (7) Philips head screws located around the perimeter of the enclosure rear. • Remove the enclosure rear being careful not to stress cable assemblies that run between the enclosure front and rear. • To disconnect the membrane keypad tail from the Control Board, hold the blue connector and pull. Do not pull the tail itself, as damage will almost certainly result.
4	• Remove the nut and washer securing the HEPA filter. • Remove the old HEPA filter and discard. • Install the new HEPA filter. • Replace the nut and washer securing the HEPA filter.
5	• Connect the CWS4000 to mains power. Exercise care, as there will be dangerous voltages present on some internal parts of the CWS4000. • Read and note the run hour meter on the control board. Hour digits are sequentially displayed followed by an "h", "r", and a pause. • Mark the HEPA filter with the hour meter reading and date of replacement. • Record these figures in the CWS4000 service record. • Reset the filter life 1000-hour counter by pressing and holding the switch in front of the hour meter display. A steady green FILTER STATUS indicator and a long beep will indicate the successful reset of the 1000-hour counter. • Disconnect the CWS4000 from mains power.
6	Replace the rear panel by reversing step 5 above.
7	Confirm that the CWS4000 functions correctly by undertaking a performance inspection as detailed in Section 4.3 above.

5. TROUBLESHOOTING

5.1. Warming Blanket Will Not Inflate

- Make sure the CWS4000 is plugged in to an energized mains power socket-outlet.
- Check both ends of the delivery hose for proper connection.
- Check the delivery hose and warming blanket inlet for kinks.
- Check that there are no obstructions to the air inlet slots.
- Check the warming blanket for damage. If air is flowing from the hose, try another warming blanket. Small rips or tears in the warming blanket may be temporarily repaired with adhesive tape.
- Request qualified service personnel check for a clogged or dirty filter.
- Check for fault alarm.

5.2. Standby Indicator Will Not Light

- Extremely high storage temperatures (such as those found motor cars on hot summer days) can cause the temperature limit thermostats in the CWS4000 to actuate. Should this occur, the STANDBY indicator will fail to light when the CWS4000 is connected to mains power. If this occurs, simply wait for the CWS4000 to cool down and eventually the thermostats will automatically reset and the STANDBY indicator will light.
- Request qualified service personnel check for blown mains power fuses.

5.3. Equipment Repairs

Repairs to the CWS4000 should be performed by qualified personnel such as certified biomedical electronics technicians or clinical engineers familiar with repair practices for servicing medical devices, and in accordance with the CWS4000 Service Manual. Damage to the CWS4000 or malfunction may otherwise result.

6. SCHEMATIC DIAGRAM DESCRIPTION

This section describes the CWS4000 schematic diagrams. Reference should be made to the printed circuit board (PCB) component legend contained in Section 7 and the schematic diagrams contained in Section 8 below.

The following should assist with the interpretation of the Schematic Diagrams:

- The schematic diagrams are organised in a flat structure.
- Electrical connectivity is shown by continuous wires or net labels on partial wires.
- Net labels (signal names) are prefixed with a forward slash when they are asserted with logic "0" (eg: /SIGNAL).

The CWS4000 Control Board implements the following functions:

- Microcontroller.
- RS232 transceiver (Control Board revision E and later).
- Microcontroller reset circuit.
- Fan control.
- Heater control.

- LED display drivers.
- Run hour meter display.
- Filter life hour counter reset switch.
- Buzzer.
- Power supplies.

The CWS4000 Sensor Board implements the following functions:

- Digital temperature sensor.
- Temperature limit thermostats.

The more important of these functions are elaborated below.

6.1. Control Board

Microcontroller

The microcontroller (U1) integrates a number of functions:

- CPU.
- Program ROM.
- RAM.
- EEPROM.
- Interrupt controller.
- External interrupts.
- Counter/Timers.
- Watchdog timer.
- Digital Input/Output ports.

The microcontroller performs the following functions:

- Monitors the exhaust air temperature through the digital temperature sensor.
- Monitors the push-button switches.
- Controls the display and buzzer drivers.
- Controls the heater and fan.

The microcontroller ROM is factory programmed with the application software program. The software program contained in the microcontroller ROM is subject to copyright. In the event of a microcontroller fault, Care Essentials must fit a replacement part.

Reset Circuit

When the microcontroller is reset either by power-on or by the watchdog timer:

- Digital Input/Output ports 0 – 3 go high.
- Signal /FAN goes low switching on the fan relay.
The fan blower is switched on.
- Signal /HEAT goes high switching off the heater triac.
The heater is switched off.

Thus the reset process implements a safety strategy to prevent the fan blower being turned off with the heater being turned on.

Power-On Reset

Following power-on capacitor (C3) charges from zero to +5V (VCC) through resistor (R1) connected to ground. This causes the Reset input of the microcontroller to be momentarily asserted high. The microcontroller type used on Control Board revision E and later has an internal power-on reset circuit and capacitor (C3), resistor (R1) and diode (D1) are not fitted.

Watchdog Reset

The microcontroller watchdog timer is incremented regularly by the microcontroller hardware. When a watchdog timer overflow occurs the microcontroller is reset.

To prevent such a system reset the microcontroller watchdog timer is reloaded before it overflows by the application software program. If the microcontroller suffers a hardware or software malfunction, the application software program will fail to load the microcontroller watchdog timer. This failure will produce a system reset on overflow thus preventing the microcontroller from running out of control. This prevents a potentially hazardous situation from occurring.

6.2. Sensor Board

Digital Temperature Sensor

The temperature sensor (U1) is controlled by and communicates with the Control Board microcontroller (U1).

Temperature Limit Thermostats

The maximum air temperature is not only limited by the control system but by two series-connected bimetallic auto-resetting thermostats. These thermostats are located in the exhaust air stream and will interrupt power to the CWS4000 should the output air temperature exceed a predetermined limit. The temperature limit thermostat function does not require adjustment, calibration or performance inspection.

6.3. System Block Diagram

The System Block Diagram shows the general electrical connectivity between the various CWS4000 electrical and electronic subassemblies:

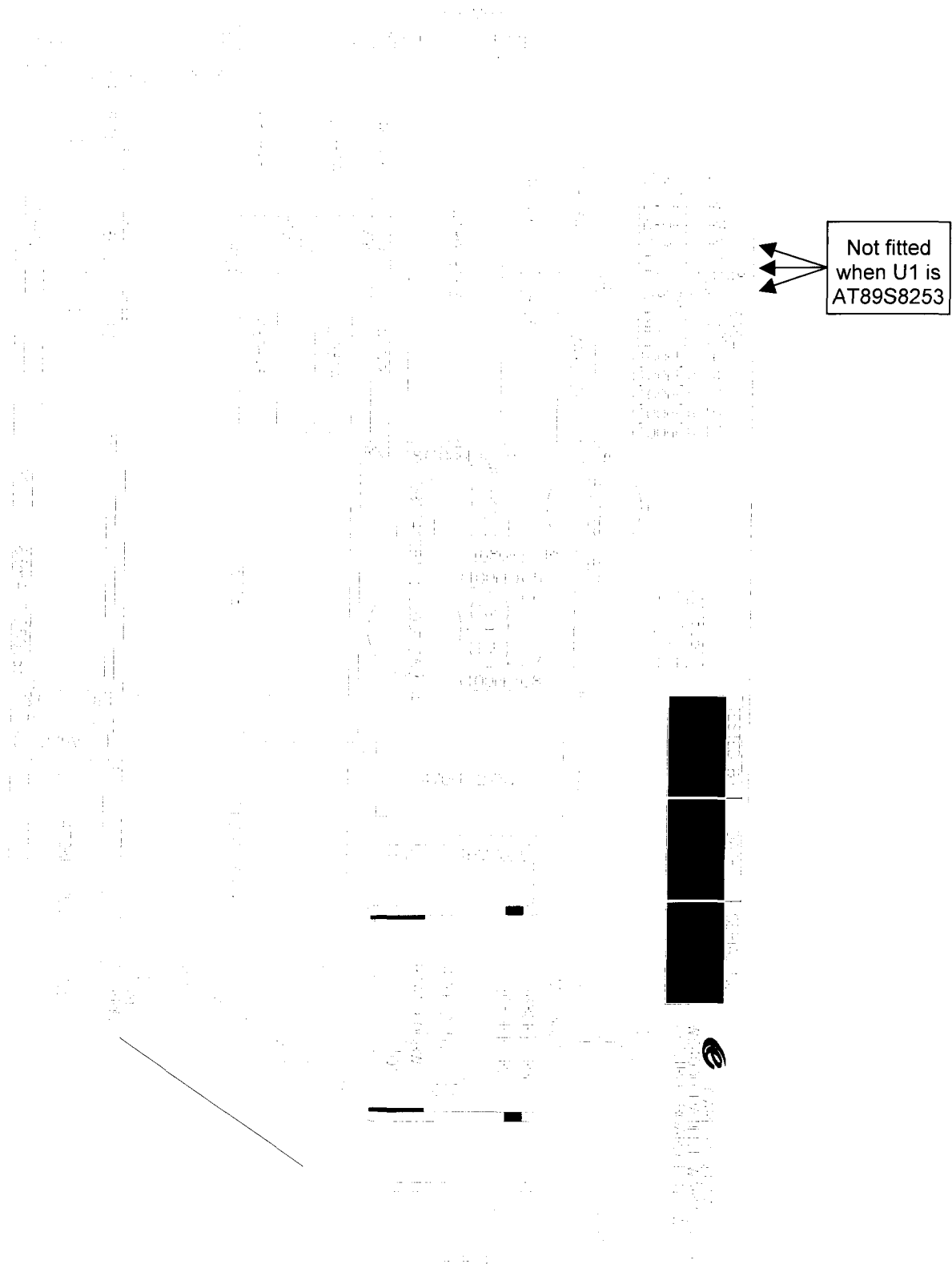
- Power inlet module including EMI filter and fuses.
- Temperature limit thermostats.
- Heater.
- Fan blower.
- Control Board.
- Sensor Board.
- Communications connector.

Before removing any of the connections between the electrical and electronic subassemblies, make a careful note so that these may be correctly reinstated. Incorrect connections could compromise patient safety and/or damage the CWS4000.

The System Block Diagram is presented as an aid to understanding the CWS4000 and does warrant extensive discussion.

7. BOARD COMPONENT LEGENDS

7.1. Control Board

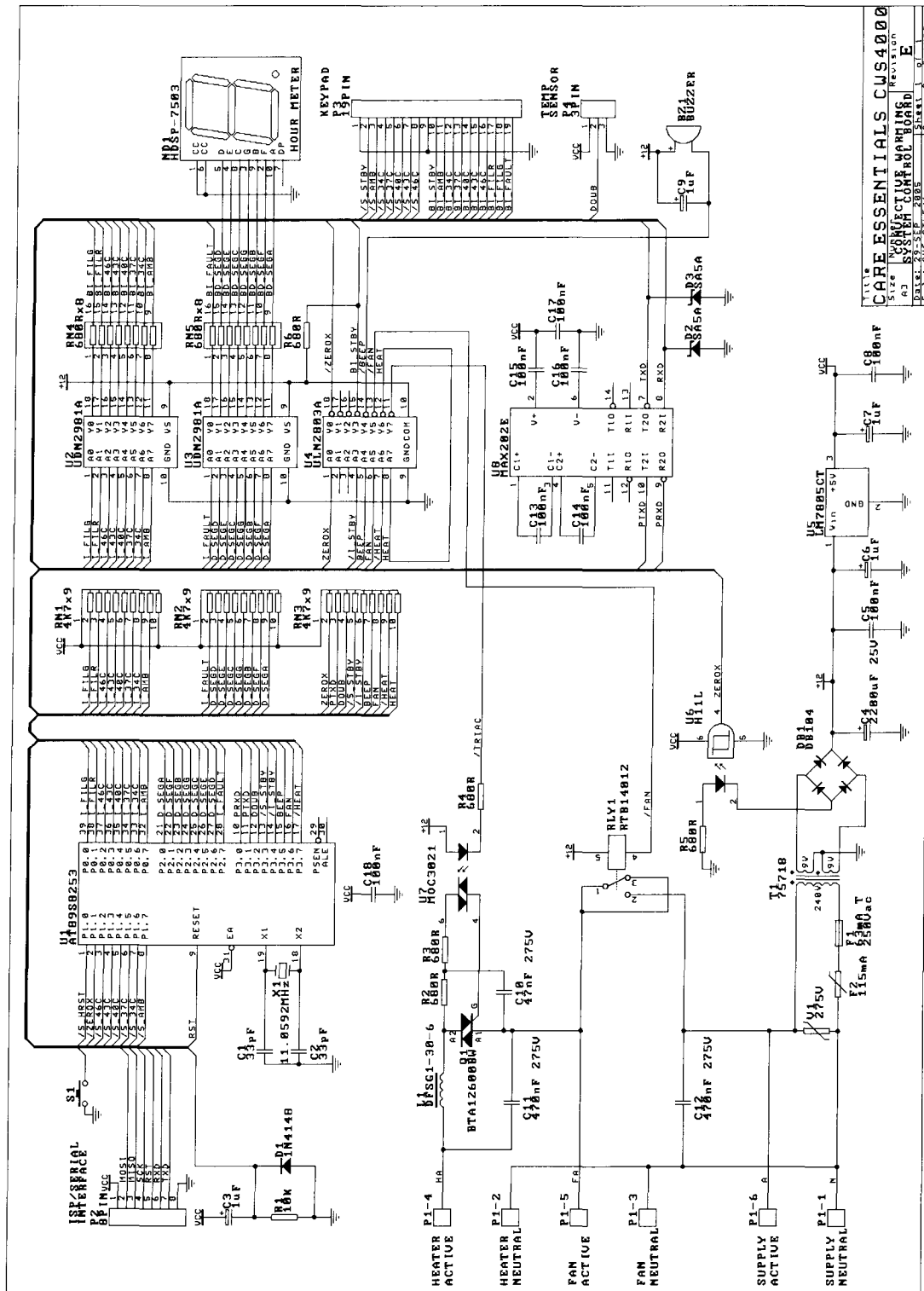


7.2. Sensor Board

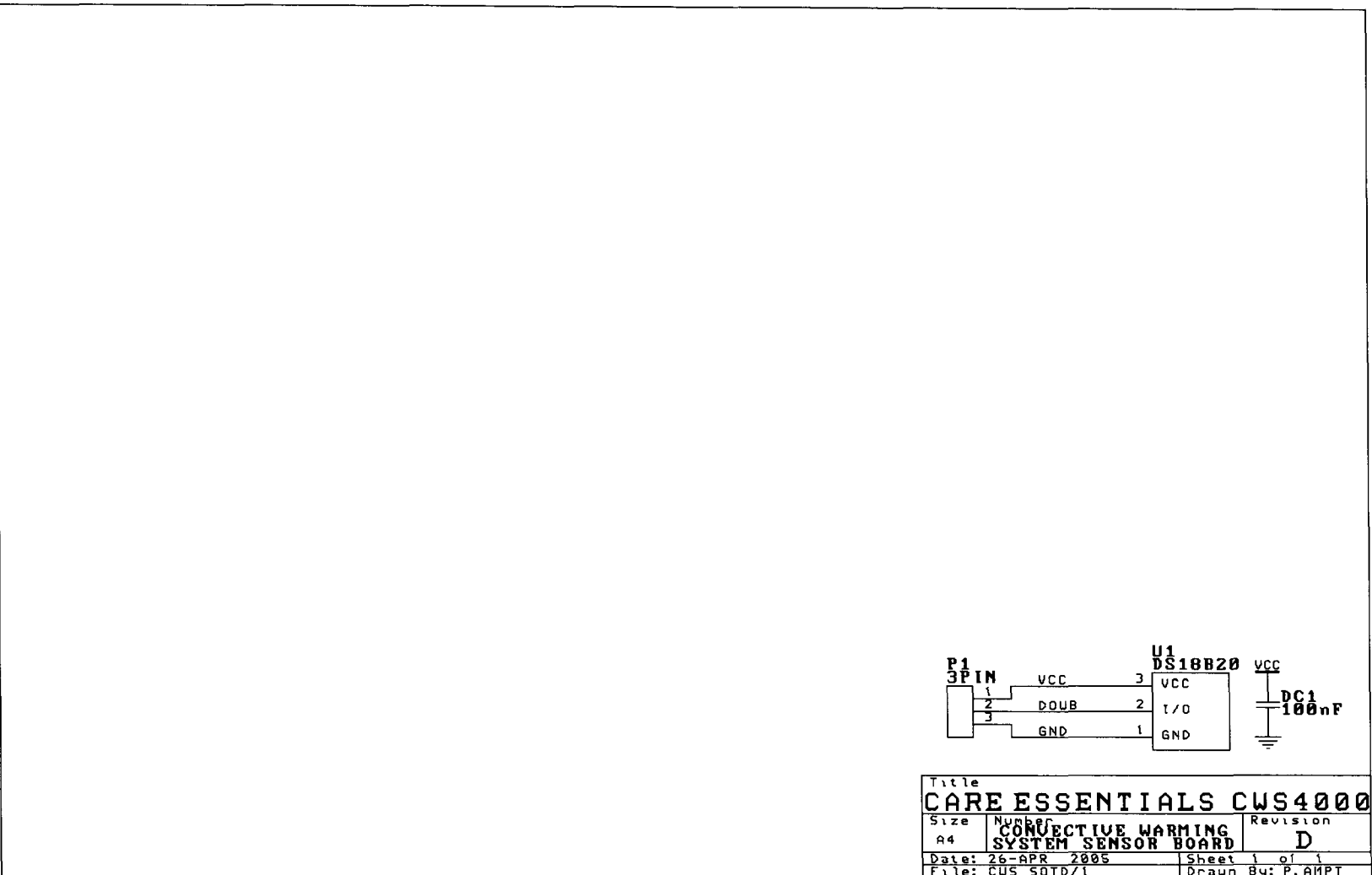


8. SCHEMATIC DIAGRAMS

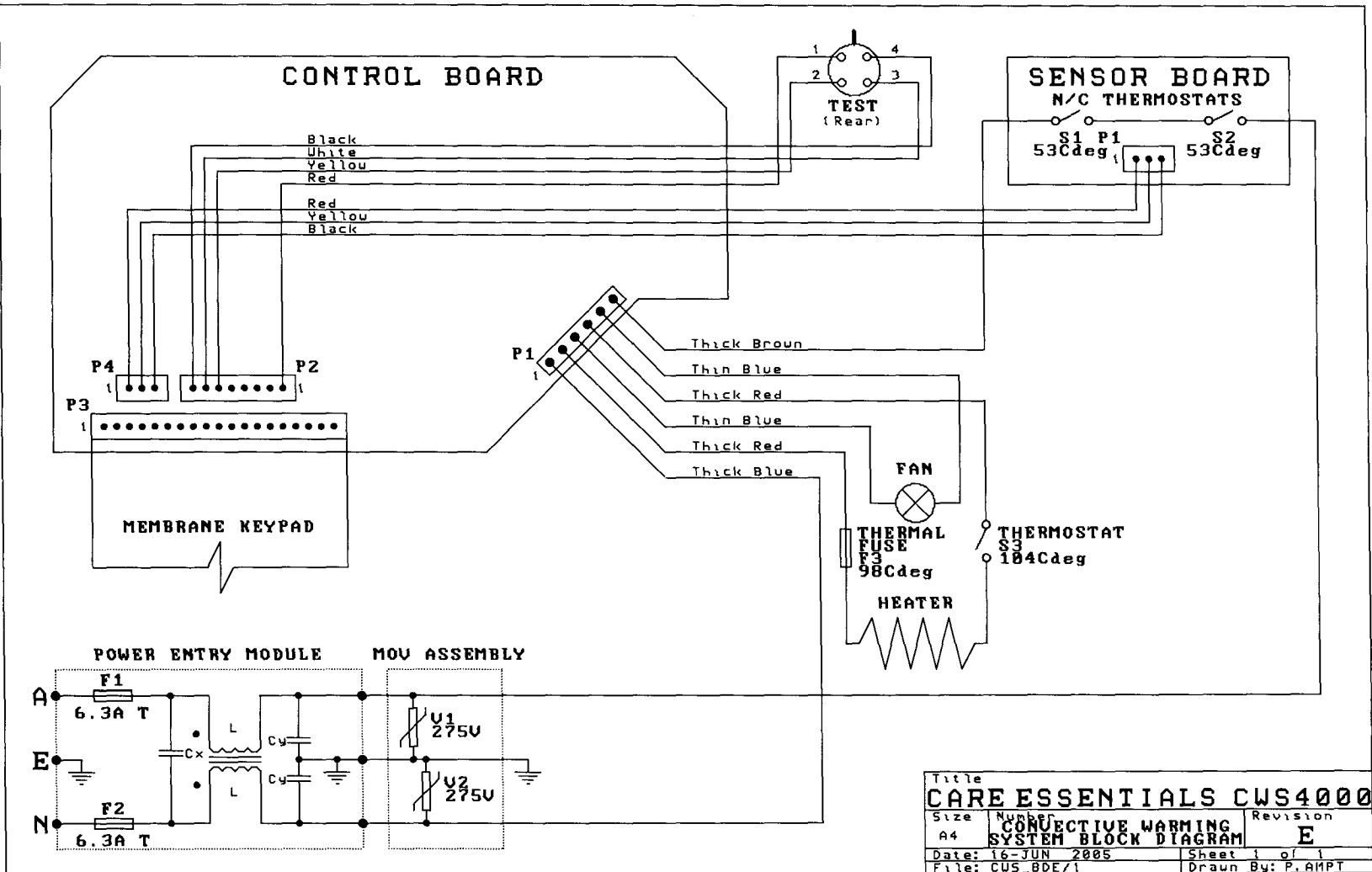
8.1. Control Board Schematic Diagram



8.2. Sensor Board Schematic Diagram



8.3. System Block Diagram



9. PARTS LIST

9.1. General Assembly

MANUF.	PART NO	DESCRIPTION	QTY
Care Ess	CWS-CTLD	Board. Control	1
Care Ess	CWS-SOTD	Board. Sensor	1
Care Ess		Membrane Switch Panel	1
Care Ess		Cable Assemblv. Active. Power Entrv – Thermal Switch	1
Care Ess		Cable Assemblv. Active. Thermal Switch – Control Board	1
Care Ess		Cable Assemblv. Active. Thermal Switch – Thermal Switch	1
Care Ess		Cable Assemblv. Neutral. Power Entrv – Control Board	1
Care Ess		Cable Assemblv. Ground. Power Entrv – Baffle	1
Care Ess		Cable Assemblv. Fan	1
Care Ess		Heater Assemblv	1
Care Ess		Cable Assemblv. Communications	1
Bussman	S504 6.3A	Fuse. Time Lag (T). 20x5mm. 250V. 6.3A	2
Schurter	5220.0643.1	Power Entrv Module. Fuseholder. Filter. Panel Mount. Snap-In	1
Harris	V275LA10	MOV. 275Vac	2
Bradv	WLB02	Label. Earth Symbol 12.5x12.5mm	1

9.2. Control Board

CIRCUIT DESIG.	MANUF.	PART NO	DESCRIPTION	QTY
(F1)	Multicomp	MCHTE15M	Fuseholder. 5x20mm. PCB Mount	1
(F1)	Multicomp	MCHTE150M	Fuseholder Cover. 5x20mm	1
(Q1. U5)	Anv		Screw. Zinc-Plated Steel. Pan-Head. M3x6	2
(Q1. U5)	Anv		Nut Zinc-Plated Steel. M3	2
(Q1. U5)	Anv		Washer. Internal S/proof Zinc-Plated Steel. M3	2
(Q1)	Beraquist	Sil-Pad K-10	Thermally Conductive Pad. TO-220	1
BZ1	Star	TMB12	Buzzer. Miniature. 8-16Vdc	1
C10	Philips	47nF 275Vac	Capacitor. Metallised Polypropylene. Class X2. 275Vac. 0.6"	1
C11. 12	Philips	470nF 275Vac	Capacitor. Metallised Polypropylene. Class X2. 275Vac. 0.9"	2
C1-2	Philips	33nF	Capacitor. Ceramic. 50V. 0.2" Pitch	2
C6. 7. 9	Rubycon	1uF 50V	Capacitor. Electrolytic. 50V. Radial. 0.2" Pitch	3
C4	Multicomp	2200uF 25V	Capacitor. Electrolytic. 25V. Radial. 0.2/0.3" Pitch	1
C5. 8.13-18	Multicomp	100nF 50V	Capacitor. Ceramic. Z5U. 50V. 0.2" Pitch	8
D2-3	Multicomp	SA5A	Transient Voltage Suppressor. 5V 500W	2
DB1	IR	DF04	Diode. Bridge. 400V 1A (4 Pin Plastic DIP)	1
F1	Bussman	S504 63mA	Fuse. Time Lag (T). 20x5mm. 250V. 63mA	1
F2	Philips	2322 660 57693	Thermistor. PTC. Overload Protection. Trip 115mA	1
HS1	Thermalloy	7025B-MT	Heatsink. TO-220	1
L1	Timonta	DFSG1-30-6/A	Choke. Saturating. 6A	1
ND1	Agilent	HDSP-7505	Display. LED. 7-Segment. Common-Cathode. HE-Red. 0.3"	1
P1	Phoenix	MSTBA25/6-G508	Header. PCB Mount. 6 Wav. 0.2" Pitch	1
P2	Molex	22-27-2081	Header. Square Pin. Friction Lock. PCB Mount. 8 Wav. 0.1"	1
P3	AMP	3-103321-0	Header. Square Pin. PCB Mount. 19 Wav. 0.1" Pitch	1
P4	Molex	22-27-2031	Header. Square Pin. Friction Lock. PCB Mount. 3 Wav. 0.1"	1
Q1	SGS	BTA12-600BW	Triac. 600V. 12A. Snubberless (TO-220)	1
R2-6	Multicomp	680R	Resistor. 0.25W 1%	5
RLY1	Schrack	RTB14012	Relay. SPDT. 12Vdc Coil. 240Vac 12A Contacts	1
RN1-3	Bourns	4610X-102 472	Resistor Network. 9x4K7 Resistor with Common (10 Pin SIP)	3
RN4. 5	Bourns	4116R-001 681	Resistor Network. 8x680R Resistors (16 Pin Plastic DIP)	2
S1	Bourns	7906H-001-000	Switch. Pushbutton. PCB. SPNO. 6x6mm	1
T1	Polykom	750718	Transformer. Mains Step-Down. 240V:9V:9V 7VA	1
U1	Atmel	AT89S8253-24PC	Microcontroller. 8-Bit. 12K Flash. 24MHz (40 Pin Plastic DIP)	1
U2-3	Anv	UDN2981A	Driver. Darlington. 8-Channel (18 Pin Plastic DIP)	2
U4	Anv	ULN2803	Driver. Darlington. 8-Channel (18 Pin Plastic DIP)	1
U5	National	LM7805CT	Voltage Regulator. Linear. Positive. +5V (TO-220)	1
U6	Fairchild	H11L1M	Optocoupler. Schmitt Trigger Output	1
U7	Fairchild	MOC3021-M	Optocoupler. Triac Driver	1
V1	Harris	V275LA10	MOV. 275Vac	1
X1	IQD	L108K	Crystal. 11.0592MHz. (HC49/4H Can)	1

Note: R1, D1 and C3 are not fitted when U1 is an AT89S8253-24PC.

9.3. Sensor Board

CIRCUIT DESIG.	MANUF.	PART NO	DESCRIPTION	QTY
	Any	TBC	Screw, Zinc-Plated Steel, Pan-Head, M3x6	4
	Any	TBC	Nut Zinc-Plated Steel, M3	4
	Any	TBC	Washer, Internal S/proof Zinc-Plated Steel, M3	4
	Keystone	8916	LED Spacer 0.4"	1
	TI	1NT01-L53-11	Switch, Thermal, NC, 53°C Opening Temperature	2
DC1	Multicomp	100nF 50V	Capacitor, Ceramic, Z5U, 50V, 0.2" Pitch	1
P1	Molex	22-27-2031	Header, Square Pin, Friction Lock, PCB Mount, 3 Way, 0.1" Pitch	1
U1	Dallas Maxim	DS18B20	Thermometer, Digital, 0.0625°C Precision (TO-92)	1

10. WARRANTY

The CWS4000 is warranted free of defects in material and workmanship under normal use and operation for a period of two years, under the terms and conditions of the Care Essentials warranty in place at time of purchase. During the warranty period, Care Essentials will repair or replace at its sole option, free of charge, any defective parts or products returned with prior authorization prepaid to Care Essentials. Consumable items such as filters are excluded. The full warranty is available from Care Essentials upon request.

This warranty does not cover products abused, misused, or altered outside the factory. There are no obligations on the part of Care Essentials for consequential damages arising out of or in connection with the use or performance of the product. Care Essentials disclaims all implied warranties including but not limited to, the implied warranties of merchantability and of fitness for a particular purpose.

This warranty does not cover the following accessories or consumables; filters, hose covers, power cords, or accessory blankets.

11. SPECIFICATIONS

ELECTRICAL	
Supply Voltage	230 – 240 Vac
Supply Frequency	50 Hz
Supply Power	1100 Watts Maximum
External Fuses	2 x 6.3 Amp 250V Time Lag (T) 5x20mm
Heater	1000 Watt heating element
Fan Motor	45 Watt
CLASSIFICATION	
Applied Parts	Warming Blanket & Delivery Hose
Applied Part classification	Type BF
Device classification	Class 1
Mode of operation	Continuous
Degree of protection against ingress of liquid	No protection against ingress of liquid
Degree of safety in the presence of flammable anaesthetic mixtures with air/oxygen/nitrous oxide	Not designed for use in the presence of flammable anaesthetic mixtures with air/oxygen/nitrous oxide.
Environmental conditions required for operation	16°C to 29°C, Less than 90% relative humidity, non-condensing
Environmental conditions required for transport and storage	10°C to 40°C, 45% to 95% relative humidity, non-condensing
Method of disinfection	Surface disinfection is possible using a cloth moistened with a mild, non-staining, disinfectant solution.
PERFORMANCE	
Temperature settings indicate the average air temperature at the end of the delivery hose	Ambient, 34°C, 37°C, 40°C, 43°C or 46°C Note: The air temperature around the patient is affected by the ambient air temperature, the warming blanket type and the use of an insulating blanket placed on top of the warming blanket.
Temperature accuracy of delivered air, except for the ambient temperature setting	± 2°C with delivery hose cover. Not specified without delivery hose cover.
Environmental conditions required to achieve the specified temperature accuracy	20°C to 22°C, 30% to 70% relative humidity, non-condensing
Time required to attain the specified temperature accuracy of delivered air following a change in temperature setting	5 minutes
SAFETY SYSTEMS	
Dual temperature limit thermostats	Either of two independent 53°C self-resetting thermostats removes power from the CWS4000 if the delivered air exceeds a preset limit temperature.
Heater temperature limit devices	A 98°C thermal fuse and 104°C self-resetting thermostat protect the filter from excessive temperatures.
Temperature limit alarm	Continuous temperature monitoring guarantees that the temperature of the delivered air maintains its specified accuracy.
Control system failure alarm	Continuous self-monitoring by the control system ensures that it always functions predictably.
PHYSICAL	
Dimensions	29 cm x 22 cm x 40 cm
Weight	6 Kilograms
Enclosure	Flame-Retardant ABS-PC Plastic
Filter type	Bacteriological HEPA filter
Filter life	1000 hours

12. APPROVALS